Frontline

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Great Lakes Forestry Centre

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DEVELOPMENT OF INTEGRATED FOREST MANAGEMENT/HARVESTING PLANS FOR BIOMASS SUPPLY OPERATIONS IN REMOTE COMMUNITY SETTINGS

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Introduction

Since time immemorial, Aboriginal communities have relied on the natural environment to meet their life sustaining and spiritual needs. For generations, burning wood (or biomass) has been part of the Aboriginal way of life. Biomass district-heating is the combination of new technology with a traditional source of energy.

Biomass district-heating systems generally consist of a biomass-fuelled central furnace/boiler system and a network of insulated pipes. The boiler heats water, which is distributed to a number of buildings connected to the system. The heated water is used for space heating and production of potable hot water, and is then returned to the central furnace to be reheated and re-circulated. Two attractive options for remote communities include district-heating and minidistrict-heating systems. Community goals and physical layout will determine which system is appropriate.

A district-heating system is usually designed to meet the heating requirements of all or most of the homes and public buildings in a community. District-heating can be a particularly good approach during the planning phase of a new community since its design can minimize the length of the underground piping. In fact, it is unlikely that retrofitting existing residences would be cost effective for a community-wide district-heating system. For a community to consider the integration of a community scale district-heating system, it must be a long-term goal for new residential developments in existing communities.

A minidistrict-heating system may be attractive for communities that wish to heat clusters of buildings. A logical cluster might consist of a school, teacher residences and any other buildings (e.g., Band office, health clinic, etc.) that are relatively close to one another (i.e., within 50 metres) (McCallum 1997).

Some primary reasons for examining the use of biomass burning systems as a heating alternative include:

- cost savings;
- employment generation;
- improved retention of funds within the community;
- enhanced community self-reliance;
- decreased potential for fuel spills;
- reduced net-gain in air pollution (CO_2) because the heating systems are carbon neutral (McCallum 1997);
- reduced household fire hazard; and,
- a readily available source of abundant natural resources.

A number of communities throughout Canada have successfully implemented district-heating systems that rely on wood biomass as the primary source of energy. Two Aboriginal communities, Ouje-Bougoumou Cree Nation in northern Quebec and Grassy Narrows First Nation in northern Ontario, provide examples of the successful construction and operation of biomass-fuelled heating systems. The source of biomass for these two communities is wood fibre waste (i.e., sawdust and woodchips) produced at nearby sawmills.

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This note contains a basic description of the components involved in developing an integrated forest management and biomass-harvesting plan for remote communities. It is based upon an Integrated Forest Management Harvesting Plan that was completed for the remote community of Eabametoong First Nation in northern Ontario. The community is examining biomass as an alternative heating source to provide a cost effective and renewable energy source. The remoteness of the community presents a unique situation, as the neighbouring forest is devoid of any competing commercial or industrial forest users and the biomass to fuel the system will need to be harvested from the forests which surround the community. The need to harvest biomass requires special considerations of numerous options that must be addressed when examining biomass heating.

A systematic approach is being taken with the Eabametoong First Nation project to ensure that the integration of a wood biomass heating system is feasible and cost effective. Figure 1 shows a sample approach that can be used as a guide for communities that might be considering biomass heating.

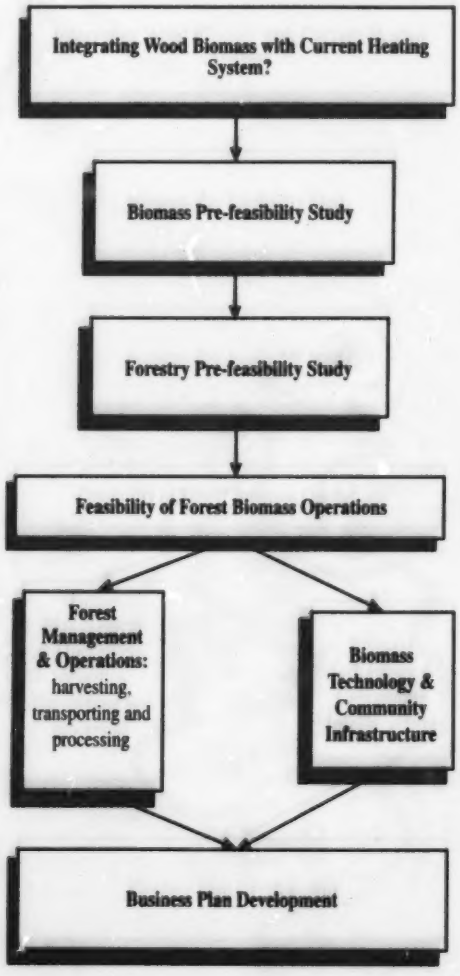
Integrating Wood Biomass with Current Heating System?
Biomass Pre-feasibility Study
Forestry Pre-feasibility Study
Feasibility of Forest Biomass Operations
Forest Management & Operations: harvesting, transporting and processing
Biomass Technology & Community Infrastructure
Business Plan Development

Figure 1. A sample approach for integrating forestry operations with a biomass heating system.

Pre-feasibility studies will ensure that the community is aware of any potential problems that may impede the integration of a biomass district-heating system. The biomass pre-feasibility study will provide a general idea of whether or not the project shows promise. Next, a forestry pre-feasibility study will examine various options for a biomass supply system and determine which is most feasible for the community. If both these pre-feasibility studies show promise, and the community wishes to proceed, a full feasibility study should be commissioned.

The purpose of this note is to provide a summary of many of the considerations that need to be examined for the development of a Small-scale Integrated Forest Management/ Harvesting Plan for wood biomass (i.e., woodchip) production. Proper planning is required to not only ensure that adequate resources are available to supply and operate the biomass heating system economically and effectively in perpetuity, but also to ensure that forest sustainability is not compromised. Under normal circumstances, the development of a forest management plan is a much more comprehensive process than that described herein.

The preparation of a forest management plan depends foremost on the ownership of the land on which the forest is located. In First Nation situations where off-reserve resources are required, the First Nation will need to abide by provincial regulations governing forestry and environmental protection. The principal consideration is usually the long-term health and sustainability of the forest.

Pre-feasibility Study

The development of an Integrated Forest Management/ Harvesting Plan is only one component in the development of a biomass heating system. Numerous technical issues also require resolution for the system to work properly. For example, a major consideration when discussing minidistrict-heating systems is clustering of buildings to minimize piping distance, and correspondingly to increase cost effectiveness. It is recommended to also investigate other independent heating options such as small hydro, solar, wind, etc., as they may prove to be more feasible, or in fact, could also be feasible working in conjunction with wood-biomass district heating systems.

As an introductory step, communities are advised to conduct a pre-feasibility study to determine the potential viability of a biomass option. The pre-feasibility study is designed to quickly and cost-effectively provide an outline of available options and the volume of biomass required to operate a biomass burning system. Furthermore, the results reveal whether or not a community should advance to the next stage of determining the viability of this alternative-heating source. An estimate of facility costs should also be revealed in the results.

Pre-feasibility studies are often conducted with readily available information at minimal cost. CEDRL (CANMET Energy Diversification Research Laboratory), a division of Natural Resources Canada, has produced a standardized pre-feasibility analysis tool called RETScreen™ to assist in determining potential for using alternative heating sources. For further information on conducting a pre-feasibility analysis using RETScreen™, contact CEDRL (see Resource Material section).

Forest Planning

If a pre-feasibility study determines that potential for a biomass heating system exists, some form of management plan or operational plan must be developed. An Integrated Forest Management/Harvesting Plan, as described in this report, is the combination of a forest management plan and a harvesting plan. Forest management plans typically set long-term goals and objectives, usually for a 5-20 year period. A harvesting plan is usually developed annually and is based on the broader direction provided by the forest management plan. Because the amount of biomass required for the Eabametoong case study was relatively small and the harvesting was to occur on Reserve lands, the forest management and harvesting plans were combined into an Integrated Forest Management/Harvesting Plan. Forest management planning requirements will vary depending on the land classification (e.g., Reserve, Crown, private) of the harvest area.

While the development of the Integrated Forest Management/ Harvesting Plan is based upon the wishes of the community members, it may be feasible to seek professional expertise if it doesn't exist in the community. Communities should consult Canadian Forest Service or provincial government publications to seek direction for the development of a forest management harvesting plan for Reserve lands. Conducting harvesting operations on Crown land requires further special planning and approval considerations, which vary between provinces. Local provincial authorities should be contacted.

Two publications that may be useful in the development of a forest management plan for biomass production are: *A Forestry Management Planning Strategy for Remote Communities* (Puttock *et. al.* 1998) and *Woodchip Supply System Options for Remote Communities* (McCallum 1999).

Although expertise in forest management planning and harvesting is an important factor, the community can gather much of the information outlined in the following report sections. Following the process discussed in the sections will ensure that the plan meets community needs and should also help reduce plan preparation costs.

Community Consultation

Foremost in the development of any forest management plan is community consultation and input. Because timber harvesting will be a component of the plan and the most obvious result of its implementation, the need for community input becomes even more important. Identification of community values, such as traplines, trapper cabins, burial grounds, medicinal plant gathering areas, hunting areas, spiritual sites, and berry picking sites, is needed as these values must be considered when planning biomass harvesting operations. Community consultation will also identify community needs, objectives, and capacity. The best plans are those developed by community residents.

Goals and Objectives

A major part of any planning exercise is the setting of objectives to guide the process. In forest management planning the objectives for managing the forest are defined by the landowner. In the case of Reserve lands the *"owner"* is usually the community. The community should have clearly defined and understood objectives for management, including any legal forest management planning requirements. When defining objectives, it is important that the planning process is conducted in an open and consultative manner to gain input from a broad spectrum of residents. Smith *et al.* (1995) suggest that a forester or natural resource expert guide the development of goals and objectives for the forest management plan (see Resource Material section).

Resource Needs

It is essential that the community consider its current level of timber consumption, and the impacts that a biomass-fuelled heating system may have on forest sustainability. For example, if the requirements of a biomass facility increase the travel distance for community members to gather fuelwood, options may need to be considered to mitigate its impacts. Two alternatives could be:

- to build roads to access a biomass supply from stands further away from the community, or
- to access stands on adjacent Crown land.

Each of these two options has special implications to be considered when developing the forest management plan, particularly if access is an issue. Road construction, simply for purposes of biomass extraction will increase operating costs associated with a biomass operation, possibly to the point where it compromises economic viability. In such circumstances, road development might only be economical if road plans are consistent with the development of additional business opportunities (e.g., sawmilling), or with community objectives regarding access development for another purpose (e.g., community expansion, accessing gravel deposits, etc.).

The community should also consider local industries that may complement a biomass heating system. Waste generated from local sawmills might be used as a fuel source. Considerations might also include establishing a sawmill to supply lumber for local building needs and use the waste by-product material in the biomass system. The establishment of an integrated sawmill/biomass-heating system allows for better utilization of available natural resources. Furthermore, operating costs can be reduced for both systems through

more efficient use of equipment. An integrated operation will also produce other benefits (e.g., increased employment, an affordable supply of lumber for community usage, etc.), which in turn, will help to increase project feasibility in the long-term.

Generally any tree species can be used for a biomass heating system, so an effort should be made to utilize tree species not heavily used by community members, such as poplar and birch. The community must also consider the volume of available forest resources. Forest sustainability must be the paramount consideration throughout the planning process. The Canadian Council of Forest Ministers defines sustainable forest development as: *"The development of forests to meet current needs without prejudice to their future productivity, ecological diversity or capacity for regeneration."* (CCFM 1996). Forest sustainability involves the consideration of environmental, social and economic impacts of forest management. Community consultation is the best way to address social and economic impacts.

To ensure that timber harvesting operations have little or no negative impact on the environment, it is imperative that the community retain expertise in forest management, operational supervision and wildlife management. The intent is to complement traditional knowledge with scientifically based expertise in the development and implementation of forest management activities.

Current Capacity and Project Needs

It is difficult to imagine that biomass heating might not be economically viable in communities that are surrounded by an abundance of forest and are currently paying a premium for fossil fuels. When compared to an oil heating system, the initial capital and set-up costs of a biomass burning facility, can be quite high. This, together with the need to have trained individuals harvest and deliver biomass, and operate and manage the burning facility, leaves many communities with a difficult choice:

- continue to burn fossil fuels (since this option is tried and financially manageable); or,
- invest large sums of money (in the initial stages of development) in a technology that requires constant and vigilant attention from a number of trained individuals.

The latter choice might require the community to seek additional financial support or partners during the early years of operation.

To reduce initial start-up costs an inventory and analysis of existing community resources can be conducted. This inventory is done to determine the resources currently available and assess their utility in a biomass operation. In addition, this inventory will highlight upgrade or modification requirements and associated costs necessary to install and operate a biomass heating system and to implement the associated Integrated Forest Management/Harvesting Plan. Review of the following three areas should be completed:

- Human Resources
- Equipment Resources
- Funding

Human Resources

Timber harvesting operations require special skills and training to ensure worker safety and proper management of the operation. Many communities have individuals with some training and skills that can be used in a harvesting operation. For example, community members may have forest firefighting training, which includes instruction in first aid and operation of chainsaws. While the current level of training held by these individuals is inadequate for working in a timber harvesting operation, they are intermediate steps. Community members with significant experience in forestry operations and those with post-secondary education in forestry or natural resource management would also be useful in the development and implementation of the operational plan and supervision of the operations.

Equipment Resources

In addition to human resources, some basic equipment needs must be met to harvest biomass. The selection of a woodchip supply option requires the evaluation of many factors. *Woodchip Supply System Options for Remote Communities* (McCallum 1999), outlines two wood supply options:

Option 1: Utilize Conventional Forest Machines, e.g., skidder or forwarder, log truck or dump truck and wood chipper; and

Option 2: Utilize Forestry-Guarded Tractor and Forestry Implements e.g., 4 wheel-drive farm tractor and tractor-powered forestry attachments (winch, grapple loader trailer, bulk dump-trailer and wood chipper).

Each of the two options has advantages and disadvantages that a community must evaluate before deciding which system will work best for them. The report by McCallum (1999) is an excellent reference document and should be consulted before selecting a supply system.

A list of some common equipment available in most communities and its potential role in a biomass operation is presented in Table 1.

These types of equipment are often under-utilized in many communities. Excavators and dozers for example, are often only used in summer construction projects. Winter projects, such as a harvesting operation, will increase use and decrease equipment payback time.

Table 1. Potential equipment use in a biomass harvesting operation.

Equipment	Potential Role
Front-end Loader	Piling / moving chips, snow plowing
Tracked dozer	Road building, some timber skidding
Excavator (with log clam e.g., grapple attachment)	Log handling (piling, feeding chipper) Road building
Dump Truck	Transporting chips or logs
Chainsaws	Felling, delimbing, bucking tress

Funding

The community will need to examine its current financial situation to determine if the necessary funds are available to establish a district-heating system. If funds are not available within the community, funding from government or loans will be necessary. Government funds may be available for training purposes, but capital costs often require loans. A feasibility study should show what type of cost savings could be expected from the adoption of a biomass fuelled district-heating system. From this feasibility study a detailed business plan can be developed to secure loans and funding.

Outstanding Operation Requirements

Once current capacity or resources are evaluated, outstanding equipment and human resources requirements must be identified. The chosen supply system will dictate which equipment the community should consider. The volume and type of biomass required to fuel the burner will dictate the type and size of machinery and the size of the required workforce.

Larger volumes of biomass will generally require longer operating periods and/or larger machinery to ensure production levels are achieved. Current requirements and future developments must be examined. The selection of appropriate machinery may require external expertise. Equipment that is either too small or too large can present production or economic challenges, which can in turn have an impact on project feasibility.

Training

As with any new venture, proper training will be essential to ensure success of the operation. Human resources capacity building depends on training for specific equipment-related tasks. Each task will require completion by a trained individual(s), usually related to the operation of a specific machine (e.g., chainsaw, skidder, chipper). As well, the entire workforce will require training in safety related aspects of carrying out the tasks. Training programs should be provided to a number of individuals within the community. More people than needed should be trained to ensure that a pool of trained staff is available.

New capacity, developed as a result of a biomass operation, is not restricted to being used in just this single project. This new capacity may assist in developing further ventures of this kind (e.g., expansion of biomass heating) as well as providing support for the community to venture into related projects (e.g., sawmilling, off-Reserve forestry initiatives). A successful biomass harvesting operation will leave a community better suited to undertake additional projects in forest management.

Special Assistance

The development of an Integrated Forest Management/ Harvesting Plan and its various components requires expertise not commonly available in most communities. The report *A Forestry Management Planning Strategy for Remote Communities* (Puttock *et al.* 1998) provides a framework of the various requirements of any forest management plan.

Some areas of the Integrated Forest Management/Harvesting Plan that will require special expertise are:

- Mapping;
- Forest Resource Inventory (F.R.I.);
- Determining sustainable harvest levels;
- Five-year management schedule;
- Development of renewal strategies; and,
- Development of best management practices.

Foresters are trained to perform these functions, and to facilitate the setting of community objectives and providing general planning guidance. A forester can also advise on the most suitable supply system and set up an appropriate training schedule. Forestry consulting firms are available to assist with these tasks and provide overall guidance for the development of the plan. Contact the local office of the provincial/territorial forest management agency, other First Nations or the Canadian Forest Service for names (see Resource Material section).

Community Approval

The basic philosophy advocated in the development of the management/harvesting plan is for the community to guide the planning process and project through all stages. Community involvement in the process is necessary to generate long-term community support for the project. Although outside expertise may be necessary to complete various sections of a plan or to facilitate the completion of the final document, the plan should reflect the wishes, input, and goals of the community. Because the plan is intended to support a community biomass project that targets its residents

as the primary beneficiaries, the community should be responsible for approval of the plan and its periodic up-dates.

Challenges

As with any planning exercise the development of an Integrated Forest Management/Harvesting Plan includes challenges. Some common challenges in the development of forest management plans are:

- Lack of an accurate forest resource inventory;
- Lack of current aerial photography;
- Knowledge about government regulations regarding forest management on Crown land;
- Divergent community opinions regarding forest management and harvesting; and,
- Lack of an adequate road system to access suitable operating areas.

Forest Inventory

Forest inventory information is critical to the development of an Integrated Forest Management/Harvesting Plan. It consists of both aspatial and spatial information, which forms the basis for determining forest sustainability. Aspatial information includes a list of forest stands with corresponding data about tree species, stand age, tree height and density or stocking. This aspatial information is used to calculate timber volumes and sustainable harvest levels. Spatial information consists of maps showing the location of forest stands across the landbase and their sizes.

Provincial governments have typically been responsible for collecting and maintaining forest resource information on Crown lands. In recent years, the trend to privatise these responsibilities has led to the compilation of forest resource information only for those forest lands under licence for commercial forest management. Thus, inventory information for forests not licenced to forest industry including Aboriginal Reserves is no longer gathered and compiled.

Aerial Photography

Aerial photography falls partially under the Forest Inventory section as it is the most commonly used method for updating information with respect to timber areas depleted due to harvesting or natural causes. Aerial photography is also important for laying out harvest area boundaries and determining future road locations. Aerial photography plays an important role in all phases of biomass supply from planning through to operations. Generally, aerial photography is useable for a number of years until such time as forest features have significantly changed, through either natural processes (fire, forest succession) or harvesting. Aerial photography is usually redone for specific areas after harvesting to get an accurate picture of actual operations. The number of years between obtaining new aerial photography of harvest areas can range between 1-5 years, depending on the scale of harvest and government regulations.

The acquisition of aerial photography is often expensive. Means to reduce the cost might include covering a larger area and sharing costs with other interested parties (e.g., other First Nations in the local area or industrial partners in situations where First Nations can develop partnerships for forest resource management).

G.I.S.

Many forest management agencies and companies use Geographic Information System (G.I.S.) technology to facilitate management, analysis, retrieval and reporting for large spatial data sets. G.I.S. is used primarily for data compilation of forest/stand specific data (aspatial) and the production of maps (spatial). Aspatially, this technology can be used to generate expected volumes and calculate sustainable harvest levels. Spatially, this technology is used to indicate areas of concern (e.g., traplines, trappers' cabins etc.), location of forest stands and identification of stands eligible for harvest. This computer-based technology is widely accepted but is generally expensive to acquire and maintain.

Government Regulations

Depending on the ownership of the land, various Federal and Provincial regulations will apply to the forest management planning process.

In some instances, depending on the needs/demands, a community may not have a large enough Reserve landbase to sustain a biomass supply. It may then become necessary to operate on adjacent lands. If harvesting operations are proposed on Crown lands, special regulated planning requirements must be followed. Often timber rights for areas surrounding or in close proximity to First Nation communities may be licensed to forest products companies. In such cases, the community will likely need to obtain allocations from the licence holder as regulated by provincial legislation.

Regardless of land ownership, timber resources to sustain the operation of a biomass system usually exist in forested areas. The circumstances for any individual community will vary and there may be a need to retain an expert consultant to ensure all applicable regulations are followed.

Community Benefits

Implementation of a biomass district and/or minidistrict-heating project can create a suite of benefits for the community, including:

- increasing community independence (forest biomass rather than delivered fossil fuel), thereby cycling funds within the community;
- creating employment opportunities for local residents;
- developing a showcase operation as a demonstration to community members and other communities, of the benefits of managing and harvesting forests in a sustainable manner;

- developing and initiating forest harvesting training programs that will provide a broad base of trained people for off-Reserve forestry related opportunities;
- improving equipment utilization; and,
- providing a small-scale operation as an opportunity to develop a successful business venture that can be expanded to include a range of forestry related opportunities (e.g., more biomass initiatives, sawmilling, fuelwood provision for the community, off-Reserve prospects).

The benefits of biomass heating systems are not limited to forest management. Biomass heating also offers convenience and improved safety. Communities that fully participate in biomass heating in the form of district-heating, will no longer have to worry about gathering/buying fuelwood or house fires caused by wood stoves. Communities that adopt minidistrict-heating systems for clusters of buildings should notice a reduction in the amount of money being spent on importing fuel-oil to the community, and a reduction in storage capacity now required. Advances in technology have made biomass heating a viable option for just about any community within a reasonable distance of a biomass supply. Remote communities should find the benefits of biomass heating particularly attractive.

Recommendations

The following is a list of recommendations that are important for the success of a forest biomass production operation to supply a biomass burning system:

- Operations should include, where feasible, equipment that the community already owns.
- The forest management plan should reflect the wishes of the community and must consider other users and uses of the forest (e.g., trappers, wildlife)
- One person (and an alternate) should be charged with the responsibility for the management of the biomass supply system, including harvest area layout for forest operations.
- Layout of proposed harvest areas for the first few years should be completed during the summer prior to operations, by a forester, forestry technician or other person suitably trained for the task.
- The harvest area layout should include training for a person from the community to do the harvest plan layout in future years.
- A cut-and-skid certification-training program should be implemented to ensure that personnel possess the necessary skills to work safely.
- A forester should be retained to ensure that the harvest level is sustainable and operations are planned to minimize environmental impact.

Government agencies are available to aid in the development of a biomass minidistrict or district-heating system. Funding or expertise may be available for communities interested in the development of a biomass heating system.

Actions Checklist

Communities that are interested in investigating biomass heating are encouraged to follow a number of steps:

1. Complete a pre-feasibility study to determine the type of biomass heating system that best applies to community circumstances. Reviewing *"Small-scaled automated biomass energy heating systems: A viable option for remote Canadian communities"* (McCallum 1997) and other reference materials is encouraged.
2. Assemble/acquire forest information. The following items should be included:
   - Forest resource inventory maps
   - Aerial photography (the most recent)
   - Maps showing the locations of values that are important to community members (e.g. trappers' cabins)
3. Retain the services of a professional forester to guide the process and prepare forest management and operating plans.
4. Ensure that the community is apprised of and understands the entire project.
5. Schedule community meetings with the forester to prepare community goals and objectives; present to the community an outline of the project; and, solicit community feedback with regards to areas most acceptable for forestry operations.
6. Complete an equipment and human resources inventory to determine required capital start-up costs and training needs.
7. Prepare draft forest management and operating plans.
8. Present forest management and operating plans to the community.
9. Make revisions based on community feedback and develop final plans.

Much of the above process is iterative and a schedule should be developed whereby the community as a whole can review progress of the plan and suggest changes. Follow-up to the plan will include various aspects such as the development of a training program, a comprehensive feasibility study and a business plan to use for leveraging funds (see Figure 1).

Resource Material

The following publications are available from the Canadian Forest Service:

CCFM Canadian Council of Forest Ministers. 1996. Criteria and Indicators of Sustainable Forest Management in Canada - Technical Report. Nat. Resour. Can., Canadian Forest Service, Ottawa, ON. 145p.

McCallum, B. 1999. Woodchip supply system options for remote communities. Nat. Resour. Can., Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, ON. Info. Rep. GLC-X-3. 19p.

McCallum, B. 1997. Small-scaled automated biomass energy heating systems: A viable option for remote Canadian communities? Nat. Resour. Can., Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, ON. NODA Note No. 30. 7p.

Ouje-Bougoumou. 1993. On the Road to Self-Reliance: The impact of alternative energy technology on community development. 24p.

Puttock, D.; McGregor, D.; Bevilacqua, E. 1998. A forestry management planning strategy for remote communities. Nat. Resour. Can., Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, ON. Info. Report GLC-X-2. 13p. + glossary.

Smith, P.G.; Scott, G.; Merkel, G. 1995. Aboriginal forest land management guidelines: A community approach. National Aboriginal Forestry Association. Ottawa. 113p. + appendices.

In addition to these publications, provincial natural resource management agencies may have additional publications that apply to timber harvesting operations.

For further information on biomass district and minidistrict-heating systems and RETScreen™, please contact Nathalie Meloche, Natural Resources Canada, CANMET Energy Diversification Research Laboratory (CEDRL), 1615 Lionel-Boulet, P.O. Box 4800, Varennes, PQ J3X 1S6. (Phone: 514 652-4621), (Fax: 514- 652-5177).

Web site: http://cedrl.mets.nrcan.gc.ca/retscreen/

The following people have been involved with the development of this note and can be consulted for a comprehensive list of the forestry expertise that is available across the country.

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